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ABSTRACT

This document contains three papers on key skills and competencies and human resource development (HRD). "Career Related Competencies" (Marinka A.C.T. Kuijpers) reports findings from surveys completed by Dutch employees who identified these issues: self-reflection is more important than career control; age and gender influence attitude toward career actualization; employment level is related to self-presentation competence; and career actualization is highly related to an individual's perception of career success. Based upon the findings, an instrument for identifying and measuring competencies for goal and value achievement is presented. "Project Management Competencies Needed by HRD Professionals: A Literature Review" (Charlotte M. Nitardy, Gary N. McLean) reviews the current literature on project management competencies, which focus on scope, time and cost; and suggests their application to HRD responsibilities such as job evaluations, staff development, recruitment and selection, training needs analysis and planning, job descriptions, and assessments and appraisals. "The Determination of Key Skills from an Economic Perspective" (Jasper B. van Loo, Bert Toolsema) defines key skills based on an economically inspired framework and applies the theory to survey results of Dutch vocational education graduates, whose key skills were found to be problem-solving, independence, oral presentation/speaking, accuracy/carefulness, initiative/creativity, and contactual. All three papers have substantial bibliographies. (AJ)

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Career Related Competencies

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This study will outline the changing nature of careers in the workplace, and trace the development of an instrument for identifying and measuring competencies for goal and value achievement. The relationship between competencies, personal factors, and career success has been studied amongst 1584 employees (51,5 % response) in 16 Dutch companies. The outcome of this analysis will be presented.

Keywords: Career Development, Career Development Competencies, Career Actualization

In research and practice of Human Resource Development there is a growing emphasis on the personal responsibility of the employee for his or her career development. This is related to the idea that careers are becoming more unpredictable and boundary less (Defillippi. & Arthur, 1996). This results into the question which competencies are required to reach goals and values in the career. In this paper results are presented on the following research questions:

- Which competencies for career development can be distinguished?
- What is the relation between career development and the personal factors (gender, career phase and position)?
- What is the correlation between career development and career success?

This study is part of a PhD project about a career development model.

Career Development and its Competencies: Some Theoretical Foundations

It seems that you can not read an article, paper or dissertation on Human Resource Development which doesn't elaborate on the changes of labor and labor market, and its consequences. These changes mark the transition from the industrial to the post-industrial society (Meijers, 1995) and have resulted in the knowledge economy, that can be characterized by increasing market forces, innovation, career mobility and competition for which fast and permanent learning is essential (Thijssen, 1995). Careers have become more unpredictable and boundary less (Defillippi. & Arthur, 1996). Because of this development, in the last decade the career of a person's professional life has been emphasized. Hall & Mirvis (1995) state that in the past mainly the employers felt responsible for the career development of the employee, but that 'career ownership' defines a new meaning in the future, because organizations will not be able to meaningfully plan a person's career due to developmental sequences. This means that the individual is on his own in career development.

Career development can be understood in two ways (dictionary on development):

- as the magnitude of achieved growth; development of the career in time (consecutive jobs and education), a career path;
- as a process to accomplish growth; in the way of exert influence on one's career path.

This study about career related competencies aims at the process of career development by the individual employee. Career development in this way is not a onetime choice for a profession or job, but a continuing process to realize goals and values in work within the possibilities of and in dialogue with the environment. In this study the word career actualization is introduced. Career actualization results in taking initiatives for and acquisition of work experiences, learning experiences and network contacts based on present and developing capacities and motivation within the possibilities of the environment.

Obviously career paths are influenced by many external factors, like labor market opportunities and professional and private circumstances (Onstenk 1995; Kidd, 1996). Furthermore, personal factors like gender, previous education and age are proven to effect the way career paths develop (Nijhof, Mulder & Streumer, 1994; Woodd, 2000). Whether or not one's career path and therefore career success can be influenced by competencies needs to be examined.

Although quite some research has been performed on (factor related to) de development of career paths (see Meijers, 1995), there is little empirical based insight on ability and behavior to exert influence on one's career development.

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In literature three kinds of competencies are mentioned to be related to the development of employees' career paths:

- Working competencies: competencies to perform in a specific work -situation or competencies for different work situations in different time periods (Onstenk, 1998; Thijssen 1997);
- Learning competencies: competencies to develop working competencies (Kessels, 1998; Thijssen, 1997; Min OC&W, 1997);
- Career related competencies: competencies to manage working and learning competencies within the personal career path. Career related competencies would be important for goal-centered career development. (Meijers, 1998; Thijssen, 1997; Carson, 1995; Hall & Mirvis 1995).

Working competencies, learning competencies as well as career related competencies affect the course of the career path. They act upon possibilities and impediments a person meets during his or her career. From the perspective that a certain extent of self control in the career is possible or even recommendable, work exceeding competencies could be of importance to develop and apply effective working competencies. These competencies are called career related competencies

In this paper career related competencies will be interpreted as clusters of ability, behavior and motivation related to a specific subject of career actualization. Career related competencies can be distinguished from working competencies because they exceed the level of specific work, they are meta competencies. A 'boundary less career' requires according tot Carson (1995) meta skills instead of job related competencies to select and accept in different settings. Meijers (1998) assumes that the core of the employability is not formed through specialized knowledge, but through the competency of getting insight of personal live values and work that fits these values.
Results of literature survey indicate that there are four career development competencies (process definition) (Kuijpers, 2000a, b):

- Self reflection: the competency to reflect upon personal capacities and motivations regarding the career.
- Work exploration: the competency to explore the labor market and specific work environment for suitable work (activities) and mobility prospect;
- Career control: the competency to plan and act upon one's own learning and working process;
- Self presentation: the competency to show and discuss one's capacities and values regarding work increasing the choices in career development.

Self Reflection

Self reflection, self research (Mensink, 1994) and self concept clarification (Taborsky & de Grauw, 1974) are central terms in research on career development and career services. Skills to reflect systematically on experiences are fundamental from the perspective of a changing labor market according to Kidd (1996). Career related research and practice, that focuses on matching persons with work requirements, puts emphasis on reflection of capacities. Meijers (1995) finds this cognitive method of approach too limited and pleads for emphasis on reflection on life values. Insight in one's motives and values in work are related to the meaning and identity of a person (Defilippi & Arthur, 1996) and is needed to be able to reach high performances.

Work Exploration

Acquire information on work related issues has been valued as being essential in career development. Gathering of *information about work* should be based on one's capacities and motivation. Information acquisition can take place on the different levels; information about work on the labor market, in a specific organization or on work activities. It handles content and development of work (Reynaert & Spijkerman, 1995; Meijers & Wijers, 1997). Another aspect of work exploration is *orientation on mobility*: the opportunities, procedures and relevant sources for transition on the labor market and in specific organizations, relevant for the capacities and motivation of a person. Crites (1984) describes the importance of using the right sources to gain information for career development.

Career Control

Based on self reflection and work exploration one can have to some extend control on his own career. Career planning is often valued as being essential; setting long and short term goals, determine activities to achieve one's goals and evaluate the results (Hall, 1987; Reynaert and Spijkerman, 1995; Kidd 1996).
Besides career planning, *control of the learning process* is of importance for career control (Onstenk, 1998). Activities of learning process control are for example: define and analyze learning questions, evaluate and obtain appropriate training and development activities.
Thirdly *control of one's work process* seems to influence career development. This indicates activities that affect the content of work in a way that work makes a better fit with one's capacities and motivation. Part of control of the work process is the balance of work and private life (Meijers, 1995; Defilippi & Arthur, 1996).

Self Presentation.

Career actualization will not be achieved by evaluation of self and work only. One should make clear to relevant others what one wants and is able to fulfil: *verbal career promotion*. Based on outcome of empirical studies Kidd (1996) emphasizes that negotiation regarding one's career is important in career development. Important factors are assertion of capacities, motivation and future career planning, together with the ability to obtain appropriate training facilities and gain support necessary for future career development. Next to the ability to express verbally the capacities and motivation is the actual *performance on the job*. One should perform well on those specific tasks that signify future career wishes. Another important factor of career development in a dynamic job-market and a dynamic organization is one's networking skills, the so called 'knowing whom' competencies (Defilippi en Arthur, 1996) for extending ones career relevant network. A *career relevant network* is the source of career related information and increases one's position on the job-market.

. These four competencies are used to study career actualization and its relation to the personal factors: gender, career phase and working position, and career success. In the next paragraph, the instrument development to measure career related competencies, the instrument and subjects involved in the main study, and the analyses will be outlined.

Methods

Instrument Development

The process of the development of an instrument for the measurement of career related competencies started with a study to clarify the important components. A literature survey combined with nine in-depth-interviews with experts on career development in The Netherlands was carried out. Experts are defined as either scientific workers who study on this subject or people who worked for a long time in de field of career development.
The interviews were analyzed with Atlas ti, a program for qualitative analysis of textual data. The text was coded, dimensions and indicators were formulated. This resulted in the division of four competencies. Based on the indicators derived from the interview texts with experts items were formulated. The questionnaire was presented to employees, researchers, methodologists and linguistic experts for advise on improvement.

For content validation five experts on career development, who were interviewed before and four experts who were not involved in the study before, were asked to evaluate the questionnaire. All nine confirmed that in general the questions measured the construct career related competencies. Furthermore four in-depth-interviews were held with experts by experience about the applicability of the distinguished competencies to their career paths. The initial developed questionnaire included 131 items to measure career related competencies. To be able to diminish the number of items and to get an indication of the reliability and homogeneity of the questionnaire, a pilot study was carried out under 197 employees (response of 42 %) from the IT and Educational sector. Based on homogeneity and reliability analyses the number of items were reduced from 131 to 69. Twelve clusters of items were formed. The four competencies were each divided in three aspects: ability, behavior and motivation.

Instrument

The questionnaire that was used in the survey consisted of 104 items of which 69 items measure career related competencies. Four competencies were divided in ability, behavior and motivation items. With regards to the ability items, the respondents were asked to judge their own ability on a Likert scales ranging from 1 (very low ability) to 5 (very high ability). On behavior items the respondents were asked to indicate to which extend he or she agreed with the given statement or how often he or she performs activities with regard to career development. On motivation items the respondent were asked to indicate the importance of a statement. Other aspects of the questionnaire are amongst others: personal factors like gender, age and working position and career success which is subdivided in career success from own perspective (5 items) and career success from others' perspective (5 items).

Subjects

The questionnaire was send to 3092 employees in 16 Dutch companies from March tot July this year. These companies were selected from a national database from the Association of Chambers of Commerce. 1598 Employees (52 %) returned the questionnaire. The response rate by the companies varied from 35% to 75%.
The questionnaire was send to employees working on high professional and academic level, with minimal one year of working experience and a minimal 20 working hours per week. The choice for the educational level was made because of the ability for reflection on ability, activities and motivation. In The Netherlands reflection on ones own performance is one of the aspect taught in college and academic education.

The group that returned the questionnaire consist of 69 percent male and 31 percent female employees. The average age of the respondents is. 39,5. 23 Percent fits in the career phase before 30 years of age, 44 percent in the phase from 30 to 45 years and 33 percent in the phase above 45 years. As for positions 49 percent works in operational positions, 22 percent in a management position and 18 percent in staff positions of which 3 percent HRD/HRM positions.

Analyses

Firstly homogeneity analysis by Homals were performed. Reliability, 'independent samples T test' and 'one way anova test' are performed of which the results are described in the next paragraphs.

Results

Reliability of Scales

Career actualization was operationalized into four competencies. These competencies were divided in ability, behavior and motivation. Cronbach's alphas of the used scales and the number of items per scale are shown in the following table:

Table 1. *Reliability Coefficients of Scale and subscales or Career Actualization and Number of Items*

Career actualization .94 (69)	Ability (A) .89 (29)	Behavior (B) .88 (32)	Motivation (M) .79 (8)
Self reflection (C1) .83 (17)	AC1 .69 (7)	BC1 .80 (8)	MC1 .63 (2)
Work exploration (C2) .80 (16)	AC2 .71 (6)	BC2 .71 (8)	MC2 .48 (2)
Career control (C3) .83 (20)	AC3 .72 (9)	BC3 .73 (9)	MC3 .56 (2)
Self presentation (C4) .84 (16)	AC4 .71 (7)	BC4 .71 (7)	MC4 .57 (2)

Scales of career actualization, competencies and modalities are reliable. Subscales of the combination of competencies and modalities regarding ability and behavior are satisfactory. The subscales regarding motivation are low, because the number of items are few.

The scale 'career success' consist of 10 items, Cronbachs alpha .75. Career success is subdivided in career success from own perspective (α: .73) and career success from others' perspective (α: .44).

Competencies for Career Actualization

To understand which competencies are relevant for career development one needs to know to what extend employees value their career actualization, or: ability, behavior and motivation on self reflection, work exploration, career control and self presentation. Table 2 shows means and standard deviations of the four competencies, the three modalities and the total: career actualization.

Table 2. *Competencies for Career Actualisation (n=1580)*

	M	Sd
Self reflection	1.61	.55
Work exploration	1.54	.54
Career control	1.45	.49
Self presentation	1.53	.55
Ability	1.55	.49
Behaviour	1.46	.50
Motivation	1.70	.72
Career actualization	1.53	.45

Employees, participants of this research, seem to be very motivated regarding career actualization. They evaluate their ability for career actualization higher than their behavior. It seems that employees mainly aim at self reflection and less on career control. Reflection on capacities (mean 1.64) mainly contributes to the high mean for self reflection. The lower score for career control is due to low means on career planning (1.41) and control on the learning process (1.43) and can not be attributed to the mean on control of the working process (1.51).
T- test results indicate a distinction between all competencies and their modalities on a significance level of .000, except the distinction between the competencies 'work exploration' and 'self presentation'.

To get more insight on the question of relevance of career related competencies, the question on the extend of relationships with personal factors and career success is studied. Gender, career phase and working position are the personal factors of which the results are presented here.

Career Actualization and Gender

The question is: To what extend differ male and female from aspects of career actualization? A T-test was performed on the grouping variable gender. The test variables were career actualization, the four competencies, the three modalities and combination scales of the last two (see table 1).
The significant differences between the groups are shown in table 3.

Table 3. *T-test (independent samples) on Career Actualization Between Gender*

Career actualization aspect	Groups Gender	N	M	Sd	T	Sig. (2-tailed)
C1	Male	1077	1.56	.55	-4.44	.000
(self reflection)	Female	490	1.70	.54		
M	Male	1076	1.67	.72	-2.86	.004
(motivation)	Female	490	1.78	.72		
BC1	Male	1079	1.40	.72	-4.27	.000
(behavior on self reflection)	Female	489	1.57			
MC1	Male	1073	1.64	1.03	-3.77	.000
(motivation for self reflection)	Female	488	1.85	1.00		
MC2	Male	1067	1.60	.87	-3.43	.001
(motivation for work exploration)	Female	485	1.76	.86		

The above indicates that women are more motivated in career actualization together with self reflection. Besides that they more motivated in work exploration but they do not regard their ability and behavior more enhanced in comparison with the male population.

Career Actualization and Career Phase

In this section is analyzed to what extent the career phase determines the motivation, ability and behavior regarding the career related competencies. The first phase includes the period from the beginning of the career till 30 years of age, the second from 30 to 45 years of age, the third from 45 years and above.

The results of the test show that young employees estimate their self reflection to a higher degree compared to other competencies and compared to employees in the second or third career phase. Young employees have high scores specifically on ability and behavior on self reflection, not so much on motivation for self reflection. On the other hand do they value motivation for work exploration and career control significantly higher than employees above 30 years of age. Also their behavior on work exploration is more extended than behavior of employees in other career phases. This is not the case for behavior on career control.
In general employees below 30 years indicate that they are more motivated and do more on career actualization. Employees above 45 years value their ability for career actualization more than employees below 45, in particular ability for career control. Although not in every case significantly, the means of the middle career phase is in general lower than means of the other phases.

Career Actualization and Position

The third personal variables that is included in the study of career actualization is the position of the employee on the workplace. Three types of positions are distinguished: management position, operational position and staff

position. Specifically was asked for HRM and HRD officers as part of staff positions, because career development can be part of their job.

Table 4. *T-test (independent samples) on Career Actualization Regarding Management Position*

Career actualization aspect	Groups	N	M	Sd	T	Sig. (2-tailed)
C4 (self presentation)	no manager	1223	1.50	.56	-3.835	.000
	manager	345	1.62	.50		
A (Ability)	no manager	1224	1.54	.49	-2.783	.005
	manager	343	1.62	.46		
AC4 (ability for self presentation)	no manager	1222	1.48	.62	-4.366	.000
	manager	343	1.64	.56		

Table 5. *T-test (independent samples) on Career Actualization Regarding Operating Position*

Career actualization aspect	Groups	N	M	Sd	T	Sig. (2-tailed)
C4 (self presentation)	no operating staff	807	1.57	.53	3.12	.002
	operating staff	761	1.48	.56		
AC4 (ability for self presentation)	no operating staff	804	1.56	.60	3.05	.002
	operating staff	761	1.46	.63		
MC4 (motivation for self presentation)	no operating staff	800	1.83	.93	3.04	.002
	operating staff	758	1.69	.96		

The results above indicate that managers find themselves more competent and operational workers are less competent in self presentation. Managers value their ability for career actualization in general more than employees in other positions, specifically for self presentation. Operational workers estimate their ability for self presentation less, but they also seem to be less motivated for self presentation.
Staff workers, including HRM and HRD officers, don't indicate that they are more motivated, able or active regarding career actualization than other workers.

Career Actualization and Career Success

An essential question regarding career actualization is whether or not career actualization correlates with career success, and more specifically to which extend competencies and modalities of career actualization covariate with career success. Career success can be valued by others or by one self. Career success is valued by others through (un)employment, level of work position in comparison with education, salary, application success, promotions and social appreciation for the work. Career success can be valued by one self in the extend one can use his/her talents in his/her work, the evaluation of the importance of the work and the success of the career path up to now, and the satisfaction about development in salary, in career and about balance between work and private life.

Table 6. *Correlations between Career Actualization and Career Success (n=1580)*

	Career success others perspective	Career success own perspective	Career success
Self-reflection	.038	.081*	.071*
Work exploration	.051	.129*	.114*
Career control	.091*	.222*	.194*
Self presentation	.210*	.297*	.299*
Ability	.161*	.295*	.276*
Behavior	.068*	.133*	.122*
Motivation	.020	.069*	.057
Career actualization	.112*	.214*	.197*

* correlation is significant at the 0.01 level

Career actualization in general is more related to career success from one's own perspective than to career success from others perspective. The evaluated ability for career actualization is most correlated to career success. The competency 'self presentation' is related to career success from the perspectives from self and others, 'career

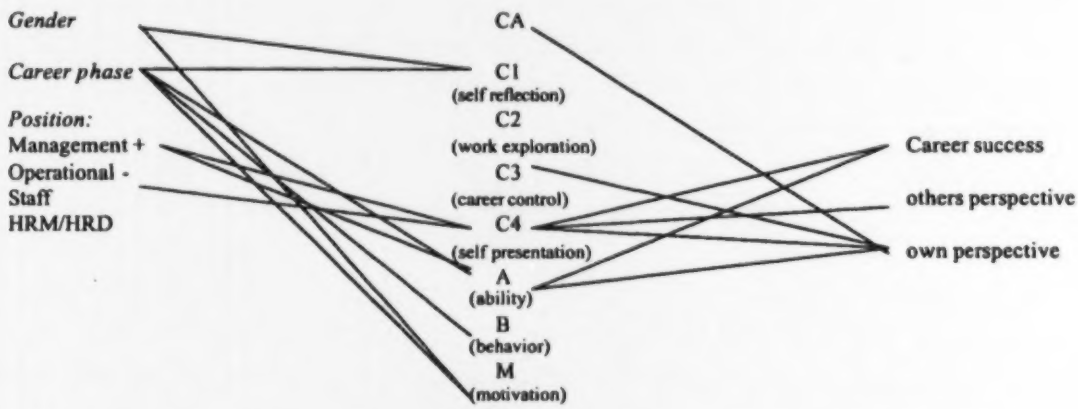
control' more to career success by own perspective. The competencies 'self reflection' and 'work exploration' are less related to career success.

Conclusion

The competencies that can be distinguished at this stage of the study are: self reflection, work exploration, career control and self presentation. These competencies, formulated based on interviews with experts and employees, were recognized in the results of the survey. Modalities of competencies that were distinguished are: ability, behavior and motivation. The (sub)scales which were developed to measure career actualization are in general reliable. The competencies and modalities distinguish themselves from each other statistically significant except for the competencies 'work exploration' an 'self presentation'.

Employees involved in this study are well motivated for career actualization. They evaluate their motivation higher than their ability, and their ability higher than their behavior. Focussing on the content aspect of competencies of career actualization the results show that self reflection is more and career control is less used for career actualization.

Personal factors which were described in this paper are: gender, career phase and work position. Female employees evaluate self reflection and motivation for career actualization higher than male employees. Younger employees (below 30 years of age) estimate their selfreflection, behavior an motivation to a higher degree than the employees in a later career phase. They also indicate that they act more upon work exploration. Employees in the career phase above 45 year estimate themselves in a higher degree regarding the ability for career actualization. Regarding the working position of employees it appears that managers value their self presentation higher than their other competencies and than employees on other positions. Employees on operational positions value self presentation lower. They are also less motivated for self presentation. Managers estimate their ability for career actualization in general higher than employees on other positions.
The personal factors that differ between groups on content and modalities of career related competencies are shown in the figure below.



In this figure is shown which competencies and its modalities are related (correlation more than .20 at .001 significance level) to career success. Career success in general is related to the competency 'self presentation' an the modality 'ability'. Career success from others perspective is only relevant related to 'self presentation'. Career success from own perspective is related to career actualization in general and to 'career control', 'self presentation' and 'ability'. The competencies 'self reflection' and 'work exploration', and the modalities 'behavior' and motivation' are less related to career success.

The figure shows that the competencies and modalities, which are regarded to be relevant for career actualization, relate differently to personal factors and career success. This indicates a distinction between competencies and modalities. More advanced analyses are needed to expand on the concept of career actualization.

Contribution of the Study to the HRD Field

Little empirical studies are performed regarding career development as a process. The PhD. study, of which some results are presented in this paper, intend to give more insight on the relation between personal and situational factors and career related competencies, and between career related competencies and career success and HRD interventions.

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Project Management Competencies Needed by HRD Professionals: A Literature Review

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Project Management is internationally recognized as a management tool that is critical for success in the current work environment. It has grown into a core competency that is recognized widely. This paper reviews the literature on project management competencies, especially as it relates to Human Resource Development. We identify competencies and training needs required of project managers operating in HRD contexts, along with proposals for further research.

Key words: Project Management, Competencies

In 1987, the American Society for Training and Development (ASTD) commissioned a competency development study for human resource development professionals (Gray, 1999). The study explored the competencies requested of prospective HRD practitioners by employers in areas of personal, business, and intellectual competencies. Project management was at the top for Business Competencies and in the top five of competencies deemed critical to the success of an HRD practitioner. Our review of the literature on project management competencies needed by HRD professionals found that project management was key in all of the competency literature.

Research Problem

Project management is a large field that has the potential for significant impact on the field of Human Resource Development. However, no research was identified that explored empirically the specific project management competencies required of HRD professionals. This paper addresses the question, What project management competencies are required by HRD professionals? This paper is the first step in a larger research project. In this paper, the literature around this question is summarized, with implications for HRD. It is the intent of the authors to follow up on this paper with a survey of HRD professionals to determine the priority of project management competencies needed by them and ways in which such competencies have been and can be developed.

The results may be used for planning by individuals, organizations, and educational institutions. Individuals may use the findings of this study to evaluate their knowledge and skills in project management. Organizations seeking individuals for HRD positions may apply the findings to their candidate search criteria. Educational institutions preparing HRD professionals may consider these data in the design, development, and evaluation of curriculum.

Specifically, do HRD professionals need project management competencies? And if so:

1. What are the most important project management areas for practicing HRD professionals?
2. Why are the areas selected by the experts the most important for practicing HRD professionals?
3. What level of project management preparation do practicing HRD professionals need in order to succeed in the field?

History of Project Management

Most of the literature on project management suggests that 1957 was the date of its birth (Devaux, 1999). From its conception, project management has been perceived as a scheduling tool–The Critical Path Method (CPM) in the construction industry is documented to have started in 1957, and Program Evaluation and Review Technique (PERT) used in some consulting companies is documented to have started the following year. Devaux concluded that project management techniques have worked with differing degrees of success, in different industries, different companies, and on different projects. Project management has grown and is now internationally recognized as a management tool that is critical for success in the current work environment (Dilworth, 2001).

Although projects have been used extensively in the construction, space exploration, and engineering fields, their application has spread to a host of industries (Crawford, 1998). Organizations have recognized the efficacy of projects to create cross-functional teams and to achieve rapid results within time and budget constraints. This has made project management a critical and powerful tool for the modern organization (Pinto & Kharbanda, 1996).

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Competencies

Competencies are commonly considered by organizations to help guide human resource development and in making human resource management decisions. Many definitions of competence exist. Frame (1999) described competence as consistently producing the desired results. A competency can also be considered a group of related knowledge, skills, and attitudes that influences performance (Parry, 1996). Ayer and Duncan (1998) expanded the definition of competency to refer to a specific, observable behavior or characteristic that leads to superior performance. There is a strong tradition of behavior-based competency research by Boyatzis (1982), and Spencer and Spencer (1993) that adds to the concept of competency by including the individual's motives, traits, and self-image or social role.

Project Management

According to Devaux (1999), every project, no mater what the industry or work type, is a compromise among three variables: scope, time, and cost. Scope is the total amount of work to be conducted or the sum of activities that will lead to the deliverable or product. The cost is the budget or the total resource usage required to accomplish the work scope. Time is the total elapsed time, from concept to completion, that it takes to perform the work scope. Thus, a competent project manager will be able to manage all three factors. According to Verzuh (1999), setting realistic expectations, fostering agreement among all parties, and then delivering the product is frequently challenging and always requires a wide array of techniques. Managing these techniques effectively is also necessary for a project manager.

Project Management Competencies

Understanding project management competence is important in job evaluations, staff development, recruitment and selection, training needs analysis and planning, job descriptions, and assessments and appraisals. According to Frame (1999), individuals and organizations have begun to see that what is needed is an internationally recognized approach to assessing the project management competencies of project managers since several project initiatives rely on these competencies. The creation of Project Management Institute's (PMI) U.S.-based, certification examination in 1984 was an attempt to fill this need for a more professional approach to competency verification. Shortly after, APM, the U.K.-based Association for Project Management began to test whether people met their project management standards. APM developed its own Body of Knowledge and launched its certification program in the early 1990s. APM felt that the then PMI PMBOK Guide did not adequately reflect the knowledge base that project management professionals needed. As described later, there is a considerable difference between these associations' bodies of knowledge.

Some have suggested that certification does not guarantee project success (Sattler & Neights, 1998). There is need to develop these skills in the context of individual work environments. One context in which little has been written on project management competencies is HRD. Also, little is known as to which competencies are correlated with project success. It does appear that a project participant does not need to acquire all possible project management competencies. Ayer and Duncan (1998) suggested that one may be missing some competencies and still be considered competent. They said that competency balance and alignment with both contingency variables and organizational project management maturity are ideal state conditions. Also, all of the research evidence (Cooper, 1993; Crawford, 2000; Morris & Hough, 1987) has shown that, in order to deliver successful projects, managing scope, time, cost, resources, quality, risk, procurement, and so forth, the PM BOK factors alone are not enough. Dinsmore (1984) outlined the attributes of a good project manager as shown in Table 1, below.

Project management bodies of knowledge (PMBOK) have been published by professional project management associations for 10 to 15 years (Morris, 2001). Not only do they provide standards against which the associations' certification programs are run, many practitioners and companies use them as best practice guides to what the discipline comprises.

However, as seen above, the fact that there are at least two quite different versions of the BOK--PMI's and APM's (IPMA's)--implies confusion at the highest level on what the philosophy and content of the profession are. Basically, the two models reflect different views of the discipline. PMI's model essentially is focused on the generic processes required to accomplish a project: on time, in budget, to scope. APM's reflects a wider view of the discipline, addressing both the context of project management and the technological, commercial, and general management issues that it believes are important to successfully accomplishing projects (Morris, 2001).

Table 1. *Attributes of a Good Project Manager (Dinsmore, 1984):*

1. Leadership
- Clear direction and leadership
- Participating in technical problem solving and decision making.
- Clearly delineating goals and objectives.
- Unifying team toward project goals.
- Delegating.
- Sound decision-making.

2. Technical Expertise
- Understand the technologies involved in the design, development, production, and fielding of the project.
- Understanding of applications, markets, and customer requirements.
- Managing technology.
- Assessing risks and trade-off.
- Predicting technological trends.
- Assisting in the problem solving.
- Communicating effectively with technical team.

3. Human Skills
- Building multi-disciplinary teams.
- Involving and stimulating personnel.
- Managing conflict.
- Communicating both orally and in writing with all levels of personnel.
- Fostering a work environment conducive to teamwork.
- Involving senior management.

4. Administrative Skills
- Project planning.
- Resource negotiations.
- Securing commitments.
- Assuming measurable milestones.
- Establishing operating procedures.
- Establishing and maintaining reporting and review systems.
- Establishing and managing project records.
- Effective use of program management tools and techniques.
- Effective manpower planning.

5. Organizational Skills
- Understand how the organization works and how to work with the organization effectively.
- Building multi-functional work teams.
- Working effectively with senior management.
- Understand organizational interfaces.
- Setting up an effective project organization.

6. Entrepreneurial Skills
- General management perspective.
- Managing a project as a business
- Meeting profit objectives.
- Developing new and follow-on business.

Source: Dinsmore, (1984, p. 129-130).

Project Management Institute (PMI) Model

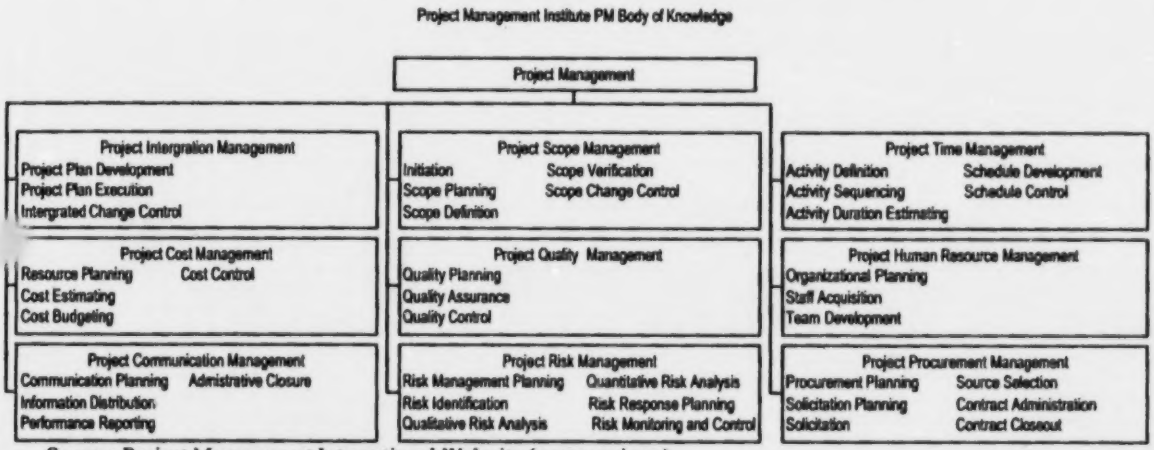
PMI, as first in the field with this initiative (Cook, 1977), established its first project management body of knowledge (BOK) in 1976. It was not until the mid-1980s that PMI's became the basis of its standards and certification program. The certification examination developed by PMI was designed to measure the knowledge-based competencies of project professionals (Frame, 1999). PMI identified nine basic functional competencies that project professionals should master, as shown in Figure 1.

Association for Project Management Model

APM's model, as seen in Table 2, was influenced strongly by research on what it takes to deliver successful projects (Morris & Hough, 1987). This research addressed the question of what the professional ethos is in project management. Is it to deliver projects "on time, in budget, to scope," as the traditional view has had it (Archibald, 1997; Meredith & Mantel, 1995), or is it to deliver projects successfully to the project customer/sponsor? In essence

it has to be the latter, because if it is not, project management is a profession that, in the long-term, business and industry is not going to get very excited about (Morris & Hough, 1987).

Figure 1. Project Management Institute Body of Knowledge



Source: Project Management International Web site (www.pmi.org).

Table 2. *Association for Project Management BOK*

General and Strategic	Control	Technical	Commercial	Organizational	People
• Project Management • Program Management • Project Context • Project Success Criteria • Strategic/Project Management Plan • Value Management • Risk Management • Quality Management • Health, Safety and Environment	• Work Content and Scope Management • Time Scheduling/Phasing • Resource Management • Budgeting and Cost Management • Change Control • Earned Value Management	• Design, Implementation and Hand-Over Management • Requirements Management • Estimating • Technology Management • Value engineering • Modelin g and Testing • Configuration Management	• Business Case • Marketing and Sales • Financial Management • Procurement • Legal Awareness	• Life Cycle Design and Management • Opportunity • Design and Development • Implementation • Hand-Over • Post Project Evaluation Review • Organizat ion Structure • Organization Roles	• Communicatio n • Teamwork • Leadership • Conflict Management • Negotiation • Personnel Management

Source: Association for Project Management, (2000, Fourth Edition)

HRD Professional and Project Management Competencies Findings

Developing HRD professionals requires a theory of competencies about what HRD professionals must know and do and a development experience based on those competencies. Many of the competencies required to be a good project manager are also required to be a good HRD professional. Table 2 shows some parallels between the first five steps in an OD intervention (Rothwell, Sullivan, & McLean, 1995) and the PM BOK. There are many similarities.

Recent research has shown that it is the project manager who emerges as the single overriding factor which decides a project's success or failure (Zimmerer & Yasin, 1998; Sattler & Neights, 1998). As more organizations

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move towards a project-based approach, the demand for project managers has outstripped supply and there is a growing international interest in the selection, training and certification of project managers (Stewart, 1995;

Table 3. *Steps in OD Intervention Paralleled with PM BOK Process Groups and Competencies.*

Steps in OD Intervention	*Brief Description from Rothwell et al.*	*PM BOK Process groups and competencies*
1. Entry	The need for change in an organization becomes apparent. A problem is discovered. Someone or groups of people in the organization look for a person who is capable of examining the problem or facilitating change.	Business problem/limitation is identified from a strategic plan.
2. Start-Up	The change agent enters the picture, working to clarify issues surrounding the problem and to gain commitment to a change effort. *Elements of Start-up* ❑ Identify the client and the sponsor(s) ❑ Becoming oriented to the clients' world; ❑ Establishing consultant's competence and credibility ❑ Developing open and trusting relationships ❑ Understanding organization's political system; ❑ Contracting the work to be done	Project Initiation ❑ Identify stakeholders who will be reviewing and approving project deliverables, make decisions and move the project along, remove business, technical or project roadblocks. ❑ Build partnership/trust with stakeholders – develop good working relationships Procurement planning Solicitation planning Solicitation Staff acquisition
3. Assessment and Feedback	The change agent gathers information about the problem and gives decision-makers and those having a stake in the change process feedback about the information.	This process is hopefully not necessary in project management because the assumption is that needs assessment has already been completed and the nature of the project determined before the recruitment of a project manager.
4. Action Planning	The change agent works with decision-makers and stakeholders to develop a corrective action plan. Action planning steps: ❑ Determine the client's degree of choice about change ❑ Determine what needs to be changed; ❑ Determine where to intervene; ❑ Choose intervention technologies Processes for developing plan: ❑ Activities should be linked to goals ❑ Activities should be clearly identified rather than broadly generalized; ❑ Discrete activities should be linked; ❑ Activities should be time sequenced; ❑ Contingent plans should exist in	Plan Scope Statement ❑ Includes a statement of business need/limitation/opportunities. ❑ Describes what is required as an outcome/project deliverables – objectives. ❑ It is a contact between the project manager/team and its stakeholders ❑ It sets expectations of the project ❑ It describes the project's scope and cost – estimating and scheduling ❑ It provides an ROI ❑ Project activity sequencing ❑ Disclose risks and how you plan to manage them ❑ Include business, technical and project assumptions ❑ Communication plan Resource planning

	case unexpected forces develop during the change process; ❑ The change plan should be supported by top management ❑ The plan should be cost effective.	.
5. Intervention	The action plan is implemented. The change process is carried out in the three performance levels: ❑ Organizational level ❑ Process level ❑ Individual job/performer	Execute–project plan execution Change and HR management ❑ Team Development ❑ Conflict management ❑ Success recognition/celebration Project Cost management – cost control Project quality management Risk management Risk monitoring and control Schedule control Scope change control Project communication management

Crawford, 1998). In order to accomplish the above eight steps of an OD intervention on time, within budget, and according to specs, an HRD professional would need to construct a work breakdown structure. According to Frame (1999), each profession has its tools, and mastery of the tools is one of the key goals of the professional. Below are some of the tools outlined by Frame (1999) that could be used in conjunction with these steps (Table 4).

Table 4. *Project Management Tools That Could Benefit HRD Professionals*

	Scope Management Tools
Work breakdown structure	A product-oriented listing of key elements of the project
Benefits-cost analysis	A project selection tool that requires organizations to assess the relative benefits of a proposed project and contrast these with project costs
Configuration management	A change-control methodology that requires meticulous documentation of changes to the project
	Time Management Tools
Gantt chart	A bar chart that portrays simply how different tasks are laid out over time
Milestone chart	A chart that pictures key milestones against a time line
PERT/CPM chart	A network diagram that shows the dependency relationships of tasks
Earned-value technique	A cost-accounting methodology that allows analysts to perform integrated cost-and-schedule-control reviews of projects
	Cost Management Tools
Cost-estimating techniques	Top-down and bottom-up techniques employed to estimate project costs
Cumulative cost curve	A method that enables staff to compare actual versus planned costs over time in order to identy levels of cost variances
Life-cycle costing	An overview of project costs that looks at operations and maitenance costs in addition to project costs.
Capital budgeting tools	Basic financial investment techniques, including present-value analysis, internal rate of return, and payback-period analysis.
Earned-value technique	A cost-accounting methodology that allows analysts

	to perform integrated cost-and-schedule-control reviews of projects
	Human Resource Management Tools
Motivation and team-building techniques	Techniques that focus on motivating matrixed resources
Management by objectives	A management approach that requires the creation of unambiguous and achievable objectives
Responsibility Matrix	A simple chart that juxtaposes resources and task listing, showing who is supposed to do what
Resource Gantt chart	A bar chart that shows how individuals resources are allocated to tasks over time
Resource loading chart (histogram)	A chart that shows the number of resources allocated to a project over time
	Risk Management Tools
Risk assessment methodology	A three-step process that entails risk identification, risk impact analysis, and risk response planning
Scenario building	The analysis of possible project outcomes using a step-by-step approach that shows how one outcome might lead to another and how these outcomes might lead to others and so on
Monte Carlo simulation	A multi-iteration, statistical technique that estimates such things as budgets, tasks durations, and resource loadings
Basic statistical concepts	Procedures including mathematical expectation, expected monetary value, mean, mode, median, and standard deviation
Decision tree	A tree-shaped diagram in which each branch represents a possible course of action, with an associated probability of occurrence
	Quality Management Tools
Standard quality control techniques	Methodologies including control charts and run charts
Pereto diagram	A chart that highlights the sources of problems leading to quality deficiencies

Source: Frame (1999, p. 55-57).

Next Steps in Research

Based on this review, we propose that the following be undertaken as research projects:

1. Using the project management competencies identified in this review, determine the project management competencies that are adjudged to be necessary for HRD practitioners and assess the principal training needs in project management for HRD professionals by establishing the gap between the level of importance of each competency and the perceived level of expertise that exists for each one among practitioners through a survey of HRD professionals and managers.
2. Through a survey of HRD academics, collect data on the extent to which project management competencies are provided in academic programs.
3. Conduct a case study of companies currently using project management competencies within their human resource development areas.

Conclusion

Skills, knowledge, and attitudes form the foundation of competence. While there is little literature yet identified, it appears that HRD professionals require project management competencies. However, achieving competency is not an end to be achieved, rather it is a road to be traveled. To be effective, one needs to develop continually new competencies in an environment that is continually changing. Academic programs and HRD professionals both have

a responsibility to insure that HRD practitioners have such competencies. To do this effectively, much more information is needed. Thus, there is a need to determine the existing level of competency of HRD practitioners, the importance of the various project management competencies for HRD, the extent to which academic programs provide these competencies, and what more is yet needed in training and in academic programs.

Implications for HRD

It is not yet clear what the implications are for HRD. Much more research is needed before it is clear. Anecdotal information suggests that managers are concerned about deficiencies in project management possessed by HRD professionals. This anecdotal information, however, needs to be replaced with more evidence from the field as to the level of competency in project management that is needed by HRD professionals, the existing level of competence, and the role of academic programs in providing these competencies.

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The Determination of Key Skills from an Economic Perspective

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We review the 'key skills' concept and design a methodology to determine which skills are key skills. Notwithstanding a large research tradition on key skills, there exists no clear criterion that is suitable to guide this decision. HRD might gain from such a criterion since an optimal investment in skills requires information on which skills are 'key' in production. Following the theoretical part, we determine key skills empirically using a dataset of vocational education graduates.

Keywords: Key Skills, Economics

Key (or 'core') skills play a significant role in the current debates on the importance of skills and lifelong learning. A large literature on key skills notwithstanding, there does not seem to be not much agreement on the exact definition of key skills. In the UK, for example, key or core skills have been defined in many different ways. Some have seen them as the way out of the over-specialized A-levels, or as a way to bridge academic and vocational tracks. For Uk's Vocational Education and Training system some have argued that core skills are a means through which skills or qualifications can be transferred to multiple (vocational) contexts (Green, 1998).

To make it even more complicated, there seems to be an international linguistic confusion about the terms themselves. In the United States key skills are usually called "basic skills" (e.g. Bynner, 1997) or "generic skills" (Stasz, 1998), whereas in continental Europe (e.g. Germany or the Netherlands) one speaks of "key qualifications" or "key competencies" (Bunk, 1994; Nijhof, 1998; Onstenk, 1997; Reetz, 1989a, 1989b).

Typically, policy documents contain lists of key skills that seem plausible at first sight, but justification for which skills should be included are not given. Part of the confusion in the field of key skills has arisen due to the fact that *skills* have been studied from many different scientific backgrounds. Psychologists have treated skills as personal cognitive or physical fitness for task completion (Anderson, 1995; Gagné, Briggs, & Wager, 1988). In sociology, skills are perceived as means for workers to identify themselves with a certain vocational population. And for economists, especially those adopting the Human Capital theory, skills are personal attributes that are required in the process of value adding in the workplace (Attewell, 1990). In education skills are treated as trainable procedural personal proficiencies, which can be measured in performance tests.

One of the main issues in modern Human Resource Development (HRD) is keeping workers' skills up to date. Due to the ongoing changes in the workplace, workforce flexibility has become an important asset in keeping organizations competitive (Watkins & Marsick, 1993). Investing in workers' skills has therewith become part of company strategy in many organizations. An efficient investment in worker skills requires, however, that information is available on which skills are most important to invest in. Up until now, presumably, most organizations have relied on the current debate for deciding on which skills to invest in. Throughout the years, different key skills have been emphasized. With the emergence of new ways of organizing work, 'team working' skills have been stressed as key skills, while the diffusion of information technology in many workplaces has triggered the emphasis on ICT skills. Although there is a growing literature on key skills, both theoretical and empirical arguments for what skills are key skills and what skills are more 'key' then others, are lacking. In this paper, we attempt to bring some consistency in the debate on key skills by developing a methodology that enables the identification of key skills from an economic perspective. The central research question of this paper therefore is: *How can we determine which skills are 'key' skills in a theoretically sound manner?* The remainder of this paper is organized as follows: In the next two sections we review the key skill concept and develop a model for determining key skills. We then discuss the methodology used to determine key skills empirically. Using a dataset of working Dutch intermediate vocational education graduates, the results of this exercise are presented in the next section. The final section concludes and summarizes.

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Theoretical Framework

Key skills: Some InsightsFrom the Literature

One of the early American examples of the use of key skills in practice can be found in 1983 in the district of Lewisville, Texas. A Superintendent's Advisory Committee conducted a study in order to determine the desired key skills of students graduating from high School. They developed a questionnaire, which was sent to community members and officials from the business and professional community. Respondents were asked to rate the skills they found important. The 62 surveyed skills fell into nine categories. The skill categories rated "important" or "extremely important" by 80% or more of the members of the business and professional community were: Decision-making Skills; Future Plans; Life Coping Skills; Physical, Social, and Personal Health; and Computational Skills (Killian, 1983). In this example key skills refer to the most *important* or *desired* skills. These skills are different from the key skills found in the UK, where key skills are of a *generic* and *transferable* nature.

In the context of vocational education in Britain, key or core skills particularly refer to the core of functioning at work. Core skills reside in the training and vocational branch of education (Tribe, 1996). The basic ideas of the UK core skills movement can be linked to a list set up by the Further Education Unit in 1979. According to this document, core skills were supposed to:

- bring about an informed perspective as to the role and status of a young person in an adult society and the world of work;
- provide a basis from which the person can make an informed and realistic decision with respect to his or her immediate future;
- bring about continuing development of physical and manipulative skills;
- bring about an ability to develop satisfactory personal relationships with others;
- provide a basis on which the young person acquires a set of moral values applicable to issues in contemporary society;
- bring about a level of achievement in literacy, numeracy and graphicity appropriate to ability and adequate to meet the basic demands of contemporary society;
- bring about competence in variety of study skills;
- encourage the capacity to approach various kinds of problems methodically and effectively, and to plan and evaluate courses of action;
- bring about political and economic literacy;
- encourage an appreciation of the physical and technological environments and the relationship between these and the needs of man in general, and working life in particular;
- bring about a development of the coping skills necessary to promote self sufficiency in young people;
- bring about a flexibility of attitude and a willingness to learn, sufficient to manage future changes in technology and career.

  (Tribe, 1996, p. 13-14)

Many lists of core skills have followed since then. Some aspects, however, come back in many lists. Core skills have been looked at as being skills that are generic and transferable, which means that they are applicable to a wide variety of occupations and transferable to many contexts. According to Tribe, most of the lists include: communications, numeracy, problem solving, teamwork, and technology skills. However, the question of which skills should be on the lists of key skills has not been approached using a scientific criterion. In practice, the skills on these lists tend to be those skills that are subjectively needed for education, everyday life and especially for work (QCA, 2000). Green (1998, p. 34-35) describes how core skills emerged in the UK:

"Core skills have emerged out of an historical absence in the UK. Alone amongst the major European nations in the 19th century, England developed a technical and vocational education that had no inherent connection with general education and schooling. Whilst on the Continent, and particularly in France and the German speaking states, the typical form of vocational training was the state-sponsored trade school, which combined workshop training with systematic instruction in vocational theory and general education, in England, with its voluntarist traditions, there were few such schools and vocational as opposed to skills training had to evolve in an ad hoc and relatively unsupported fashion [...]"

In reality in the UK, core skills refer to "just-enough" basic theoretical content. General academic education is brought into the vocational curriculum in an attempt to give vocational training a more profound general (theoretical) foundation (Tribe, 1996). Training in this sense becomes instrumental, especially to economic growth and prosperity. This has resulted in the criticism that core skills only represent the low level minimal standards of the academic content in UK's VET. General academic education is brought into the vocational curriculum as far as it underpins performance in expected work tasks and can be reduced to core skills (Green, 1998, pp. 28).

The core skills in the UK were renamed by the Qualifications and Curriculum Authority (formerly National Council for Vocational Qualifications (NCVQ) and the School Curriculum and Assessment Authority (SCAA)) into key skills. The QCA adopted a list from City and Guilds which consists of:

- Communication;
- Application of number;
- IT;
- Working with others;
- Improving own learning and performance; and
- Problem solving.

(QCA, 2000)

According to the QCA, key skills are widely applicable in work, education and everyday life. This does not help much in further defining the concept.

Across national boundaries, the literature reveals that reasons for including a skill as in a list of key or core skills have usually been political or practical. The National Institute for Literacy has recently published a study that describes the identification of key skills (Merrifield, 2000). In this study, common activities and generative skills (which appear to be closely related to the key skills concept) were defined by using an iterative procedure by a number of working groups of experts. In another document, in the context of California community colleges, the definition of core skills is left to faculty, since they "...agree on a body of skills that most or all of our students should master before graduating" (Palomar College, 1999). The European Training Foundation (Shaw, 1998) has relied on a survey among experts in the EU-countries in order to determine key skills. There have also been changes over time regarding the definition of key skills. Typically, inspired by developments taking place in the work place, employers, politicians or other stakeholders have emphasized the importance of certain skills, which has resulted in many different lists of key/core skills.

The debate on key skills would greatly benefit from a common definition. Not claiming to have found the perfect one, this is our point of departure. Within the scope of this paper we define key skills from an economic perspective. As a starting point we consider *skills* to be personal and related to productivity, restricting its scope to work. Secondly, most skills can be developed or shaped by means of education and training or experience. Some skills, however, are difficult to develop. These are usually connected to attitudes or personality. Thirdly, literature on expertise has showed that skills are especially context-bound, since they are developed and applied in specific contexts of human activity (e.g. in a specific job, with specific restrictions, or in a specific organization) (Chi, Glaser, & Farr, 1988). We may define skills as:

Individual (developed or innate) attributes representing context-bound productivity.

Key skills, as we saw in the discussion above, have appeared due to the fact that some underpinning foundation of transferability is needed at the present labor market. Stasz (1998) argued that the modern workplace is changing because of technological innovations, flatter organizational hierarchies, and increasing globalization of markets. These changes have caused a higher demand on the flexibility of the workforce, which is reflected in hiring decisions of employers. Employers increasingly demand "generic skills" next to job-specific skills. Although research by (Bishop, 1997) showed that job-specific skills are still among the most wanted and productivity-related skills, he admits that the more general and underpinning skills are important as well. Bishop, focusing at the productivity effects of skills, reflected in wage and employer satisfaction, argues that skills like reading and mathematical skills "contribute to productivity by helping the individual learn the occupational and job specific skills that are directly productive. This implies that key skills impact productivity indirectly, rather than directly. If this is the essential characteristic of key skills, they may be defined as:

Skills that have stronger indirect effects than direct effects on productivity.

The remainder of this paper is devoted to finding skills that have this characteristic. This implies a better justification of developing a list of key skills. Rather than making political statements, those skills that have a larger indirect contribution to productivity than their direct contribution may be identified as key skills.

Identifying Key Skills: An Economic Framework

The contribution of skills to economic success, and in particular to productivity, can be measured in several ways. For example, one could determine the relative importance of skills to employers, for instance by studying selection criteria. One could also relate wage inequities of groups within a population to skills profiles. Usually the educational qualifications of groups earning higher wages are compared to the qualifications of those earning less. Another methodology might be an ethnographic approach, in which one studies in detail which changes took place within production or service industry work and their consequences for skill requirements. A final example is to determine skills effects in a mathematical way by relating skills to wages (Levy & Murnane, 1999).

In economics the determination of skills that matter for wages has a rich history in the literature. In the well-known human capital literature (Becker, 1962; Mincer, 1974), skills are essentially divided into being either general or specific. Later, attention has been paid to skills that fall in between, so-called 'transferable skills' (Stevens, 1994). The attention for skills as such, opposite to composites of human capital, has led to the development of research that addresses the contribution of different types of skills to productivity or wages. This literature has usually focused on a mathematical linear relation between skills and wages of the form:

$$\ln W_i = \beta_0 + \beta_1 S_{1i} + \ldots \beta_N S_{Ni} + \varepsilon_i, \quad (1)$$

This approach has two drawbacks. Firstly, it does not focus on the relation *between* different skills, which seems essential when one tries to determine what skills are key skills. Secondly, the results of the regression analysis presented in (1) may be blurred by serious multicollinearity, since different skills tend to be strongly correlated.

In this paper, we present a different approach for determining key skills. In order to focus on the 'key' nature of the skills, we explicitly take into account the relations that exist *between* the different skills distinguished. We do this by finding the relationships between the different skills first, before performing any kind of wage regression. When key skills are considered to be skills that make other skills more productive, we may set up the following model:

$$S_{in} = c_n + \sum_{j=1}^{N, j \neq n} \beta_{jn} S_{ij} + \varepsilon_{in} \quad (2)$$

For all skills (S_n, n=1…N) this equation relates S_n to a constant and all other skills (S_j, j=1…N and j≠n). Now, in order to find the indirect effect of a skill j, we add up all the contributions of this skill to other skills, or in formal terms:

$$\gamma_j = \sum_{n=1}^{N, j \neq n} \beta_{jn} \quad (3)$$

In a second step, we set up a skill-wage equation:

$$\ln w_i = \alpha + \beta_n S_{in} + \varphi_j \sum_{j=1}^{N, j \neq n} S_{ij} + \varepsilon_i \quad (4)$$

This equation relates a skill *n* and the summation of all other skills to wages. We then use (3) and (4) to determine the marginal effect of a change in the skills. The direct wage effect of a marginal change in S_{in} is β_n. A change in S_{in}, however, also has an indirect effect on all other skills, namely γ (equation 3). Since we are dealing with marginal changes, γ can also be considered as the total change in $\sum_{j=1}^{N, j \neq n} S_{ij}$, implying that the total indirect wage effect is $\gamma \cdot \varphi$. In other words the skill-wage equation is composed of two skill effects: a direct effect of a certain skill to wages and a total indirect wage effect of the same skill. Now we can calculate both effects for each skill.

Research Questions

The research questions that evolve from the previous discussion are:

1) Which skills may be considered 'key skills', in the sense that their indirect effect on productivity is larger than their direct effect?
2) What are the direct and indirect productivity effects of these 'key skills'?

A key skill has been defined as a skill that has a larger cumulative indirect effect on other skills than on itself. In terms of equation (3) a skill is a key skill when $\gamma > 1$. The second research question is on the productivity effect of key skills. We calculate this productivity effect using equations (3) and (4), as explained above.

Methodology

In order to determine which skills are key skills, we use data from a graduate survey of Dutch intermediate vocational education graduates. The respondents where approached approximately 1 year after they graduated. During October-December 1999, 18.513 questionnaires were sent out, of which 9068 were returned. A little over 1.000 questionnaires were not suitable for data-entry, so that 7.889 cases remained. In order to focus on a group that is relatively similar in terms of activities, we selected those respondents who were working full-time (at least 35 hours) in an organization (we excluded self-employed graduates). This left us with 1702 cases for analysis.

The part of the questionnaire that is of particular interest for this paper is the list of skills. For fifteen different skills, respondents where asked to indicate on a 5 point Likert scale to what extent the listed aspects are required in their work. Using the data from these fifteen skill measures we approached skill by the so-called 'competence-in-use' concept (see Ellström, 1998), implying that skills are measured by the interaction between individual capacities and job requirements. Table 1 gives an overview of the skills investigated together with their average scores.

Table 1. *Skills in the graduate survey and their average scores*

Skills	Score
Professional theoretical knowledge (S1)	4.21
Understanding of ICT (S2)	3.84
Understanding of operational management (S3)	3.60
Putting theoretical knowledge and techniques into practice (S4)	4.07
Written presentation, writing skills (S5)	3.48
Oral presentation, speaking skills (S6)	3.95
Transfer of knowledge (S7)	4.00
Planning, coordinating and organizing activities (S8)	3.85
Problem-solving skills (S9)	4.36
Contactual skills (S10)	4.31
Co-operating, working in a team (S11)	4.47
Independence (S12)	4.60
Initiative, creativity (S13)	4.47
Adaptability (S14)	4.37
Accuracy, carefulness (S15)	4.67

Results

In this section, we apply the model previously developed to the data. In order to find the indirect skill effects, we performed for each skill a separate regression on all the other skills. In table 2, we provide the regression estimates of the parameters of the explanatory skills in the regressions.

The results in the table reveal that from the 210 coefficients estimated, 78 are not significant and therefore not displayed. Twenty coefficients have a negative effect, while 112 coefficients have the expected positive effect. The final column shows that skills that have a cumulative effect on other skills, which is larger than 1 are: Problem-solving skills, independence, oral presentation/speaking skills, accuracy/carefulness, initiative/creativity and contactual skills. According to our criterion defined earlier, these six skills may be considered key skills. When these outcomes are compared to several lists of key skills published in the literature, we find a number of skills that are comparable. A notable exception to this are ICT-skills. While these are often cited as being key skills, our methodology fails to find evidence for this.

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Table 2. *Regression estimates of the parameters in the skill regressions*

	s1	s2	s3	s4	s5	s6	s7	s8	s9	s10	s11	s12	s13	s14	s15	γ_i
s1		0.1330	NS	0.4700	-0.0886	NS	0.1230	-0.0577	0.0751	NS	NS	0.0293	NS	NS	0.0436	0.7278
s2	0.0895		0.2570	-0.0438	0.2040	0.0406	NS	NS	NS	0.0399	NS	0.0339	-0.0291	NS	0.0403	0.6324
s3	NS	0.2590		-0.0378	0.1120	0.0787	0.0596	0.1400	0.0477	NS	NS	NS	NS	-0.0315	NS	0.6278
s4	0.4160	-0.0578	-0.0495		0.0524	NS	0.1510	NS	0.0622	NS	NS	NS	NS	0.0348	0.0450	0.6540
s5	-0.0678	0.2290	0.1250	0.0447		0.2890	NS	0.1700	NS	NS	NS	NS	NS	NS	0.0279	0.8178
s6	NS	0.0564	0.1090	NS	0.3570		0.1730	0.0761	NS	0.2090	0.0555	-0.0234	0.0343	0.0312	NS	1.0781
s7	0.1180	NS	0.0840	0.1630	NS	0.1780		0.1270	0.0624	0.0500	0.0609	0.0295	NS	NS	NS	0.8728
s8	-0.0408	NS	0.1470	NS	0.1590	0.0577	0.0942		0.1540	0.0326	-0.0559	NS	0.0774	NS	-0.0407	0.5846
s9	0.1110	NS	0.1040	0.1040	NS	NS	0.0962	0.3220		0.1920	NS	0.0450	0.1040	0.0646	0.0926	1.2355
s10	NS	NS	0.0801	NS	NS	0.3030	0.0708	0.0626	0.1760		0.2300	NS	-0.0386	0.1180	NS	1.0020
s11	NS	NS	NS	NS	NS	0.0721	0.0771	-0.0956	NS	0.2050		0.0357	0.0716	0.1010	0.1060	0.5729
s12	0.0722	0.1240	NS	NS	NS	-0.0618	0.0760	NS	0.0751	NS	0.0726		0.3700	0.2120	0.2540	1.1940
s13	NS	-0.0863	NS	NS	NS	0.0733	NS	0.2180	0.1400	-0.0567	0.1180	0.3000		0.2510	0.1050	1.0624
s14	NS	NS	-0.0791	0.0667	NS	0.0569	NS	NS	0.0744	0.1480	0.1420	0.1460	0.2140		0.1320	0.9009
s15	0.0900	0.1240	NS	0.1050	0.0764	NS	NS	-0.1190	0.1300	NS	0.1810	0.2130	0.1090	0.1610		1.0704

In table 3 below we provide the direct and indirect wage effects from the wage regressions we performed. We also calculate the total indirect effect $\gamma_i \varphi_i$.

Table 3. *Direct and indirect wage effects from skills*

Skill	β_i	φ_i	γ_i	$\varphi_i \gamma_i$
Professional theoretical knowledge	NS	0.0019	0.72780	0.0014
Understanding of ICT	NS	0.0020	0.63239	0.0013
Understanding of operational management	NS	0.0031	0.62778	0.0019
Putting theoretical knowledge and techniques into practice	NS	0.0027	0.65404	0.0017
Written presentation, writing skills	0.0214	NS	0.81781	NS
Oral presentation, speaking skills	NS	0.0026	1.07806	0.0028
Transfer of knowledge	0.0202	NS	0.87276	NS
Planning, coordinating and organizing activities	0.0238	NS	0.58455	NS
Problem-solving skills	0.0251	NS	1.23552	NS
Contactual skills	NS	0.0023	1.00198	0.0023
Co-operating, working in a team	-0.0192	0.0036	0.57285	0.0021
Independence	-0.0280	0.0041	1.19403	0.0048
Initiative, creativity	-0.0224	0.0039	1.06236	0.0042
Adaptability	-0.0166	0.0036	0.90085	0.0032
Accuracy, carefulness	-0.0294	0.0042	1.07036	0.0045

The table shows that writing skills, transfer of knowledge, planning/coordinating/organizing activities and problem solving skills all have positive direct wage effects of around 2%. In contrast, co-operating/working in a team, independence, initiative/creativity, adaptability, and accuracy/carefulness all have negative direct effects on wages. Column 2 shows that of the 15 skills distinguished, 11 have significant and positive effects on wages in the range of 0.2 – 0.4%. The final column displays the total indirect wage effect from key skills. It reveals that these effects are largest for independence, accuracy/carefulness and initiative/creativity. Since problem-solving skills does not have a significant indirect effect on wages, the total indirect wage effect from this skill cannot be calculated.

Conclusions

This paper has tried to bring some consistency in the debate on key skills. Instead of making political statements by relying on ideas inspired by developments taking place in many workplaces, we have attempted to approach the key skill concept from a quantitative perspective. When key skills are defined as those skills having larger indirect effects on productivity than their direct effects, we may identify them using an economically inspired framework.

When we apply our theory to a sample of graduates, we find six key skills: problem-solving skills, independence, oral presentation/speaking skills, accuracy/carefulness, initiative/creativity and contactual skills. It is comforting that in many lists of key skills, similar aspects are included as being key skills. The often-cited IT skills, as being key in the modern workplace can, however, not be identified as a key skill using our methodology. A shortcoming of our analysis is that we cannot justify the choice of the fifteen skills we used in testing our methodology.

Although the empirical outcomes we obtained are intuitively appealing, our research methodology needs further investigation for adequacy, reliability and validity across countries, types of education and occupations in order to

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improve on the methodology for defining and determining key skills. This would imply a significant advance in the usefulness of the debate on key skills and the application of this debate in educational curricula and continuing professional education. When key skills are those skills that make the difference in peoples' careers, more research in this area is also something that HRD in general should be concerned with.

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